DOCKET FILE COPY ORIGINAL

RECEIVED

JUN 7 2001

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Carriage of Digital Television Broadcast Signals	)	
	)	
Amendments to Part 76 of the Commission's Rules	)	CS Docket No. 98-120
	)	
Implementation of the Satellite Home Viewer Improvement Act of 1999	)	
	)	
Local Broadcast Signal Carriage Issues	)	CS Docket No. 00-96
	)	
Application of Network Non-Duplication, Syndicated Exclusivity and Sports Blackout Rules to Satellite Retransmission of Broadcast Signals	)	CS Docket No. 00-2

To: The Commission

JOINT REPLY TO OPPOSITIONS TO PETITIONS FOR RECONSIDERATION OF THE ASSOCIATION OF AMERICA'S PUBLIC TELEVISION STATIONS, THE PUBLIC BROADCASTING SERVICE, AND THE CORPORATION FOR PUBLIC BROADCASTING

The Association of America's Public Television Stations ("APTS"), the Public Broadcasting Service ("PBS"), and the Corporation for Public Broadcasting ("CPB") (collectively, "Public Television")[1] submit this reply to oppositions to petitions for

---

[1] APTS is a nonprofit organization whose members comprise the licensees of nearly all of the nation's 354 noncommercial educational television stations. APTS represents public television stations in legislative and policy matters before the Commission, Congress, and the Executive Branch and engages in planning and research activities on behalf of its members. PBS is a nonprofit membership organization of the licensees of the nation's public television stations. PBS distributes national public television programming and provides other program-related services to the nation's public television stations. CPB is a private, nonprofit corporation created and authorized by the Public Broadcasting Act of 1967 to facilitate and promote a national system of public telecommunications. *See* 47 U.S.C. § 390 *et. seq.*

reconsideration of the Commission's *First Report and Order* concerning various critical issues relating to the carriage of digital broadcast television signals filed by cable television operators and programmers ("cable").[2] Cable does not adequately demonstrate why a transitional digital carriage requirement would be overly burdensome or why the Commission should not reconsider its decision to restrict "primary video" to a single stream of video programming.

I. THE CABLE ACT MANDATES ADOPTION OF A TRANSITIONAL DIGITAL CARRIAGE REQUIREMENT NOW.

A. Congress Did Not Intend To Delay A Digital Must Carry Requirement Until The End Of The Transition.

Cable once again asserts that the Act requires cable operators to carry only signals that "have been changed," which, it argues, means that they are not obligated to carry digital signals until the end of the transition.[3] First, NCTA argues that a station's signal has not been changed unless the station is no longer broadcasting in analog.[4] Cable cannot point to legislative history to support its contention, nor does this reading take into account the circumstances in which the provision was enacted. The word "changed" cannot refer to an analog signal that is replaced with a digital signal, as that would imply a flash cut conversion that is inconsistent with the Commission's assignment to broadcasters of a second channel to use during the transition.

---

[2] *See In re Carriage of Digital Television Broadcast Signals: Amendments to Part 76 of the Commission's Rules; Implementation of the Satellite Home Viewer Improvement Act of 1999: Local Broadcast Signal Carriage Issues; Application of Network Non-Duplication, Syndicated Exclusivity and Sports Blackout Rules to Satellite Retransmission of Broadcast Signals, First Report and Order and Further Notice of Proposed Rulemaking*, CS Docket Nos. 98-120, 00-96 & 00-2, FCC 01-22 (rel. Jan. 23, 2001) ("*First Report & Order*" and "*Further Notice*").

[3] 47 U.S.C. § 534(b)(4)(B); *see* Opposition of National Cable & Telecommunications Association at 6-7 ("NCTA Opposition"); Time Warner Cable's Opposition to Petitions for Reconsideration at 3 ("Time Warner Opposition").

[4] *See* NCTA Opposition at 6-7; *see also* Time Warner Opposition at 3-4.

Although "to change" can mean "to replace," its principal meaning is "to make different."[5] A broadcaster transmitting a digital signal along with its analog has "made" the digital signal "different" from the analog, even though it is simultaneously transmitting an analog signal. Therefore, the Cable Act requires carriage of the "changed" digital signal. If Congress had meant for a digital carriage requirement to take effect at the end of the transition, when a broadcaster's digital signal will replace or substitute for its analog signal, it would have used the word "substituted" or "replaced" rather than "changed."

Second, cable ignores Public Television's point that when Congress in the 1992 Cable Act directed the Commission to develop carriage rules at such time as it adopted a digital standard, it was operating under the assumption that the transition would last for approximately 15 years.[6] Certainly Congress did not contemplate that digital carriage rules would take effect 15 years from the time the Commission adopted a digital standard. Otherwise, why would it direct the Commission to initiate a digital carriage proceeding when it adopted the digital standard rather than at (or at least closer to) the end of the transition? If Congress had been ambivalent about when cable operators would be required to carry digital signals, it would not have included any temporal component in the statutory provision directing the Commission to assure cable carriage of "advanced" signals. But Congress did specify the time for assuring digital carriage:

---

[5] *See* Webster's II New College Dictionary at 186 (listing the first definition of "change" as "[t]o make different").

[6] *See In re Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service, Memorandum Opinion and Order/Third Report and Order/Third Further Notice of Proposed Rulemaking*, 7 FCC Rcd 6924, 6957-64 (1992).

early in the transition, as soon as reasonably possible after the mere adoption of the standard for digital signals. The Commission cannot ignore this directive.[7]

B. A Transitional Digital Carriage Requirement Would Not Excessively Burden Cable.

Cable continues to make much of the degree to which it would be burdened by a transitional digital carriage requirement. However, given upgrades in cable system capacity and the efficiencies of digital spectrum, the burden of such a requirement would be minimal and would pass muster under *Turner*. As a study of cable capacity prepared by Strategic Policy Research, attached hereto as Exhibit A, explains, "Among the most significant changes that have taken place in cable technology over the decades has been the continuous, if gradual, increase in the number of 6 MHz television channels that can be carried on a coaxial cable."[8] This is because the "[i]ntroduction of digital technology into cable TV systems affords a truly staggering increase in potential capacity."[9] Also, as Public Television explained in its Petition and as cable does not refute, the legislative history of the must carry statute contemplates that the Commission consider the burden on cable operators in fashioning digital carriage rules by, for

---

[7] Cable operators also argue that when there are two permissible interpretations of a statute, only one of which raises a constitutional question, the Commission must choose the clearly constitutional alternative. *See* Time Warner Opposition at 6. That logic does not apply here, however, since as explained above, there is only one permissible interpretation of the statute.

[8] Strategic Policy Research, Cable TV Capacity at 3 (2001) ("SPR Study").

[9] *Id.* at 5. The majority of cable homes are passed by upgraded cable systems with a capacity of 750 MHz or higher, which can support 110 analog channels, 220 digital channels, or a combination of the two. *See id.* at 5, 9. The SPR Study goes on to explain that due to the efficiencies of digital spectrum, at most "12 channels will be required for digital cable carriage of all local broadcasts in any market." *Id.* at 7. This maximum capacity requirement is calculated based on accommodating 23 broadcast channels, which is the maximum number of local channels a cable operator must carry in the largest markets, meaning that in many markets the number of digital channels required will be fewer than 12. *See id.* at 6-7.

example, phasing in the requirements, adjusting them for smaller systems or those with lower capacity, or making adjustments for special circumstances.[10]

In addition, a transitional carriage requirement is needed to fulfill the important government interests that the Court recognized in *Turner*.[11] Congress and the courts have recognized that a cable carriage requirement is essential to preserving the viability of free, over-the-air local television.[12] Congress and the Commission have determined that converting over-the-air television from analog to digital format is in the public interest. Accordingly, ensuring the availability of (and thereby preserving) free, over-the-air digital television through a transitional carriage requirement likewise serves the public interest.[13] More fundamentally, a transitional carriage requirement is needed to preserve over-the-air broadcasting generally (whether analog or digital) because without a transitional carriage requirement to spur the transition, the public's broadcast service will remain mired in a middle ground during which broadcasters' resources will be drained by long-term operation of dual analog and digital

---

[10] *See* H. Conf. Rep. No. 102-862, at 66-75 (1992).

[11] Those interests include preserving the benefits of free, over-the-air local broadcast television; promoting the widespread dissemination of information from a multiplicity of sources; and promoting fair competition in the television programming market. *See Turner Broad. Sys., Inc. v. FCC*, 520 U.S. 180, 189 (1997). The public's interest in completing the transition — to realize its potential for heightened and broadened services, to use spectrum efficiently, to avoid the waste of dual digital and analog operations, and to reclaim give-back spectrum so that it can be auctioned for other wireless applications — are also important government interests served by transitional carriage.

[12] *See id.*

[13] Time Warner also argues that the rationale for an analog must carry requirement does not apply to digital since the MVPD landscape has changed since *Turner* with the addition of new competitors such as DBS. Cable is still the predominant MVPD, serving nearly 70% of American households; it is the "bottleneck" conduit into cable homes since very few households have both cable and DBS. Therefore the *Turner* rationale is still compelling.

stations. The benefits of free, over-the-air local broadcast television will be lost and there will be no widespread dissemination of information from a multiplicity of sources.

II. PRIMARY VIDEO DOES NOT MEAN A SINGLE STREAM OF VIDEO PROGRAMMING.

Cable's argument that the "primary video" concept was intended to distinguish one video stream from others, rather than free video from fee-based services, is incorrect.[14] NCTA argues that broadcasters do not "identify *any* video that is not the primary video. But if *all* the video is primary, then the term 'primary video' is redundant, and the word 'primary' is completely superfluous."[15] It concludes that if Congress had intended to require carriage of all 'free' video programming, it would have used the term "free video," rather than "primary video."[16] NCTA's line of reasoning is based on the assumption that all of a broadcaster's digital video programming services would be available for free. The logical conclusion of this reasoning would be that all ancillary and supplementary services, which are offered for a fee, are pure non-video services. However, ancillary and supplementary services could be subscription-based video services.[17] Therefore, it is entirely reasonable for "primary video" to encompass all free, over-the-air programming services as distinguished from subscription services, which may include video streams for which consumers pay a fee.

---

[14] *See* NCTA Opposition at 8-10; Time Warner Opposition at 11-12.

[15] NCTA Opposition at 9.

[16] *See id.*

[17] *See* 47 C.F.R. § 73.624(c) ("[N]o video broadcast signal *provided at no direct charge* to viewers shall be considered ancillary or supplementary.") (emphasis added).

Cable's argument that "primary" modifies the singular "video transmission" is similarly misguided. "Primary" modifies "video," not "'video . . . transmission,'"[18] and "video" is a collective noun.[19] A collective noun is "[a] noun that denotes a collection of persons or things regarded as a unit."[20] "Primary video" describes a collection of programming streams that may be regarded as a unit because they are all available free, over the air. "Primary video" may therefore include more than one programming stream.[21]

Finally, as Public Television explained in its Petition for Reconsideration, restricting "primary video" to a single programming stream would be extremely damaging to consumer interests. It would be particularly harmful to noncommercial stations' ambitious plans to use this new technology to help fulfill their mission to provide programming for all Americans by offering interactive educational services how they want them, when they want them and where they want them – in homes, schools, childcare facilities, and workplaces across the country. Virtually every public station is developing bold service plans that call for the delivery of multiple educational services to their local communities; is planning to deliver one if not more multicast digital channels of formal educational services; and is engaging in exciting new partnerships with local community institutions to develop new digital content. Few will see the

---

[18] Time Warner Opposition at 12.

[19] Time Warner misses the point when it states that "broadcasters do not explain why what they call a 'generic' or 'collective' noun is more like a plural than a singular noun." *Id.* at 12 n.13. A collective noun is not more plural or more singular.

[20] Webster's II New College Dictionary at 220.

[21] To argue that broadcasters endorsed this approach by supporting adoption of must carry rules in 1986 is preposterous. *See* NCTA Opposition at 9-10. Broadcasters did not know about multicasting in 1986, *see* NAB/MSTV/ALTV Petition for Reconsideration and Clarification at 15, and to apply those statements to a completely different landscape ten years later stretches the bounds of logic.

benefits of the significant investment public television is making in multicasting services absent reconsideration of the definition of "primary video."

III. THE COMMISSION WAS CORRECT TO CONCLUDE THAT DIGITAL-ONLY STATIONS ARE ENTITLED TO MANDATORY CARRIAGE

Cable objects to the Commission's decision that cable systems carry digital-only stations in down-converted analog format provided that the station pays for the cost of down-conversion.[22] Without carriage rights for its down-converted analog signal, WHDT-DT in Stuart, Florida will, quite simply, cease to exist. Carriage of digital-only signals is essential to the survival of digital-only stations during the transition because stations unable to reach almost 70% of potential viewers cannot survive. In addition, carrying a digital-only signal in analog format requires no more capacity than carrying a broadcaster's NTSC signal, which is indisputably entitled to carriage.

IV. OTHER ISSUES

Retransmission of partial digital signals: In its Petition for Reconsideration, Public Television urged the Commission to bar the retransmission of partial digital signals, noting the potential for cherry picking. In their oppositions, cable operators argue that they should be able to negotiate for carriage of partial digital signals. For example, Time Warner states that "requiring cable operators to buy unattractive programming as a condition to the purchase of attractive programming" is government-assisted tying.[23] Yet, when responding to arguments regarding carrying the entirety of a broadcaster's signal, cable operators emphasize

---

[22] *See* Comments of A&E Television Networks at 10.

[23] Time Warner Opposition at 20.

Congress's recognition of the public interest desirability of avoiding cherry picking.[24] The Commission should reconsider its decision to allow carriage of partial digital signals and conclude that allowing cable operators to pick for retransmission only the most popular programs in a station's multicast line-up is not in the public interest.

Material degradation: In their oppositions, cable complains, without documentation or specificity, about the impossibility of developing a uniform standard for material degradation due to the variety of DTV formats available to broadcasters. However, cable operators do not respond to Public Television's proposal that the Commission condition their ability to downgrade a station's signal, for example, by downconverting it to another format only with the broadcaster's prior consent. This proposed protection (for public, as well as commercial broadcasters) would apply equally to all DTV formats and would allow each broadcaster to continue to choose which format is best for its signal.

PSIP carriage: In its Petition for Reconsideration, Public Television urged the Commission to require carriage of all PSIP material, which includes foreign language closed captioning, V-chip information, and broadcast program information. Cable operators argue that they should only be required to carry "program-related" PSIP matter (or even less), as determined by the *Further Notice*.[25] Public Television again emphasizes that the Commission should require cable operators to carry all information in the PSIP and thereby afford some needed protection against cable's further tightening its hold over what viewers can see.

---

[24] *See* NCTA Opposition at 13; Time Warner Opposition at 14.

Respectfully submitted,

Marilyn Mohrman-Gillis/a2d

Marilyn Mohrman-Gillis
Vice-President, Policy and Legal Affairs
Lonna M. Thompson
Director, Legal Affairs
Andrew D. Cotlar
Staff Attorney
Association of America's Public
Television Stations
1350 Connecticut Ave., N.W. Suite 200
Washington, D.C. 20036
(202) 887-1700 (phone)
(202) 293-2422 (fax)

Kathleen Cox/a2d

Kathleen Cox
Senior Vice President Policy, General
Counsel
and Corporate Secretary
Robert M. Winteringham
Senior Staff Attorney
Corporation for Public Broadcasting
401 9th Street, N.W.
Washington, D.C. 20004
(202) 879-9600 (phone)
(202) 879-9694 (fax)

Gregory Ferenbach/a2d

Gregory Ferenbach
Senior Vice President and General Counsel
Public Broadcasting Service
1320 Braddock Place
Alexandria, Virginia 22314-1698
(703) 739-5000 (phone)
(703) 837-3300 (fax)

June 7, 2001

[25] *See* NCTA Opposition at 18.

CERTIFICATE OF SERVICE

I hereby certify that on this 7th day of June 2001, I caused true copies of the foregoing Joint Reply to Oppositions to Petitions for Reconsideration of the Association of America's Public Television Stations, the Public Broadcasting Service, and the Corporation for Public Broadcasting to be served on the following by first-class mail, postage prepaid.

Susan L. Fox
The Walt Disney Company
1150 17th Street, N.W.
Suite 400
Washington, DC 20036

Lawrence R. Sidman
Eric T. Werner
John M. R. Kneuer
Verner, Liipfert, Berhard, McPherson
and Hand, Chartered
901 15th Street, N.W., Suite 700
Washington, DC 20005

Glenn Dryfoos
Telemundo Communications Group, Inc.
2290 West Eighth Avenue
Hialeah, Florida 33010

William L. Watson
Paxson Communications Corp.
601 Clearwater Park Road
West Palm Beach, Florida 33401

Ellen P. Goodman
Jennifer A. Johnson
Covington & Burling
1201 Pennsylvania Avenue, N.W.
Washington, DC 20004

Charles R. Allen
Station KAET(TV)
Arizona State University
P.O. Box 871405
Tempe, Arizona 85287-1405

K. James Yager
Benedek Broadcasting Corp.
100 Park Avenue
Rockford, Illinois 61101

August C. Meyer, Jr.
Midwest Television, Inc.
P.O. Box 85888
7677 Engineer Road (92111)
San Diego, California 92186-5888

John E. Hayes
Rebecca S. Bryan
Raycom Media, Inc.
RSA Tower, 20th Floor
201 Monroe Street
Montgomery, Alabama 36104

Stephen A. Weiswasser
Mary Newcomer Williams
Covington & Burling
1201 Pennsylvania Avenue, N.W.
Washington, DC 20004

Daniel L. Brenner
Michael S. Schooler
Diane B. Burstein
National Cable Television Association
1724 Massachusetts Avenue, N.W.
Washington, DC 20036

David L. Donovan
Association of Local Television Stations, Inc.
1320 19th Street, N.W.
Suite 300
Washington, DC 20036

Ellen P. Goodman
Russell D. Jessee
Covington & Burling
1201 Pennsylvania Avenue, N.W.
Washington, DC 20004

Stuart F. Feldstein
Lisa C. Cordell
Fleischman & Walsh, L.L.P.
1400 Sixteenth Street, N.W.
Suite 600
Washington, DC 20036

Nickolas Davatzes
A&E Television Networks
235 East 45th Street
New York, New York 10017

Henry L. Baumann
Jack N. Goodman
Valerie Schulte
National Association of Broadcasters
1771 N Street, N.W.
Washington, DC 20036

Victor Tawil
Association for Maximum Service Television, Inc.
1776 Massachusetts Avenue, N.W.
Suite 310
Washington, DC 20036

Randall D. Fisher
Adelphia Communications Corp.
One North Main Street
Coudersport, Pennsylvania 16915

Frank R. Jazzo
Paul J. Feldman
Fletcher, Heald & Hildreth, PLC
1300 North 17th Street, 11th Floor
Arlington, VA 22209

Henk Brands
Scott K. Attaway
Kellogg, Hubert, Hansen, Todd & Evans, P.L.L.C.
1615 M Street, N.W.
Suite 400
Washington, DC 20036

Amy L. Levine

STRATEGIC
POLICY
RESEARCH

CABLE TV CAPACITY

JOSEPH H. WEBER*

June 7, 2001

1. INTRODUCTION

The introduction of digital technology into cable TV networks has the potential for enabling vast increases in the capacity of these systems. The industry's deployment of carriage capacity, however, will be influenced by a number of factors, including technical, organizational and financial developments. Capacity deployment will also be affected by regulatory constraints, which are currently in a state of flux. In this report, we examine these influences on cable capacity deployment and consider likely scenarios for the next several years.

We first provide a review of the technical parameters of cable television systems and outline current deployments underway by cable operators to accommodate expanded television services as well as Internet access. We describe the media market environment and the financial circumstances in which cable operators now find themselves. We then consider how these factors, along with regulatory constraints, may impact the incentives and ability of cable TV systems to carry local commercial and non-commercial television broadcast signals (both digital and analog), as well as high-speed data traffic.

* Joseph H. Weber is a Principal of Strategic Policy Research, a consulting firm specializing in regulatory, economic and technological issues associated with telecommunications networks and services. Mr. Weber is a telecommunications engineer with over 30 years of experience at Bell Labs, at AT&T and as a consultant. At Bell Labs he focused on telecommunications network design and at AT&T on the interrelationships between telecommunications technology and policy. As a consultant he has been involved in technical and policy questions relating to a wide variety of technologies, including cable TV, satellite systems and wireless networks.

2. TECHNICAL CHARACTERISTICS OF CABLE TV DISTRIBUTION SYSTEMS

Cable TV systems, as distinct from satellite distribution systems, are fundamentally local in character. Because cable systems consist of networks of coaxial cables and fiber optic lines that carry signals to their eventual termination in each home, they have the ability to differentiate the services provided to each locality. Cable systems are normally configured in a treelike structure, with a "head-end," where input signals are received from programming sources (local broadcasters or network program providers) via satellites or terrestrial facilities. The signals are then distributed to the end users over the cable system's own network facilities, in the following sequence: First, the signal is directed to one of a number of "backbones" (also called "trunk lines"), consisting of either coaxial or fiber-optic cable, that emanate from the head-end. The backbones, in turn, feed coaxial cables that traverse the streets of a particular locality. These local coaxial cables are tapped, at various points, by distribution cables connecting directly into the homes.[1] The electrical signals that carry the signals are weakened (or attenuated) as they pass through the coaxial cables. Therefore, amplifiers, powered by local commercial power sources, are installed at regular intervals along the coaxial cable span in order to strengthen the signals. Fiber optic lines do not require amplifiers.

Until recently, the basic technical characteristics of these systems had changed little in the many years since the first "community antenna television" ("CATV") systems were put into place to extend broadcasts to towns and neighborhoods unable to receive reliable over-the-air signals. Within the last decade, however, cable operators have begun to expand the capacity of their systems and to replace the coaxial cables in the backbones with fiber-optic cables. The last two years have witnessed the beginnings of high-speed Internet access, digital television[2] and the proposed provision of telephone service over cable networks.

Sections 2.1 through 2.5, following, will detail the technical parameters of analog and digital cable systems and how they impact the ability of these systems to support analog and digital broadcast services as well Internet access and telephone service.

---

[1] Typically, cable systems are monopolistic in the sense that customers rarely have a choice among several cable TV suppliers (although they do have a choice between cable and satellite and, for a subset of channels, over-the-air broadcasts).

[2] This terminology can lead to confusion. Digitally *encoded* 6-MHz television channels can carry 39 Mbps of digital information, enough to support up to 12 NTSC, or "analog" signals using approximately 3 Mbps per program. If *digital broadcast signals* are carried on such a cable system, then each 6-MHz channel can carry the 19.4 Mbps digital transmissions from two broadcasters.

2.1. BASIC CABLE—ANALOG SYSTEMS

The original purpose of cable TV systems, which has driven the fundamental character of the networks to the present day, was to deliver standard NTSC (analog) broadcasts to television viewers. The NTSC broadcast signal, then as now, consisted of a vestigial sideband AM radio frequency signal requiring about 4.3 MHz of bandwidth. The addition of guard-bands to prevent inter-channel interference led to an assignment of 6 MHz of frequency spectrum for each over-the-air broadcast channel.

These broadcast signals were remodulated and retransmitted, intact, over the coaxial cable systems, which (as described above) contained amplifiers to maintain the signal at appropriate levels. To initiate service to a subscriber, the coaxial cable was "tapped" and a length of cable installed to connect the main cable to the home. Within the home, a "cable box" translated the signal into one that could be received by ordinary television sets. In recent years, the functions of the traditional analog "cable box" have been absorbed into so-called "cable-ready" TV sets. Cable boxes may still be used, however, for the reception of premium channels that have been "scrambled" to prevent unauthorized reception.

Although the basic elements of coaxial cable systems have remained unchanged since their inception, the use, extent, capacity and capability of cable systems have changed enormously. Current cable systems provide many programs in addition to those that originate over the air and are now deployed widely throughout the country. Indeed, the majority of television viewers in the United States today rely on cable as the primary means of receiving television signals.[3]

Among the most significant changes that have taken place in cable technology over the decades has been the continuous, if gradual, increase in the number of 6 MHz television channels that can be carried on a coaxial cable.

The number of channels that can be carried is determined by the bandwidth of the system. As the bandwidth (and, hence, channel capacity) of the systems increase, the spacing of the amplifiers must be decreased, since attenuation rates increase at higher frequencies. Any noise that is introduced into the signal as it moves through the cable is amplified along with the signal, so noise accumulates as the number of amplifiers increases.

Fiber-optic transmission lines, on the other hand, do not require amplifiers. A cable TV network composed partially of fiber-optic lines and partly of coaxial cables will only need amplifiers on the coaxial cable sections. If a larger portion of the network is comprised of fiber-optic facilities, then the coaxial cable runs will be shorter, and

[3] Over 65 million, or 7 out of 10 TV households, subscribe to cable television service. *See* NCTA website at www.ncta.com.

fewer amplifiers will be needed. Therefore, the solution to the problem of signal deterioration as the bandwidth increases is to extend fiber optic lines further into the network. This can be costly, but it has many benefits. Among these is the virtually limitless bandwidth of fiber optic lines—once in place, they can continue to support increases in capacity as the coaxial cable sections are upgraded.[4] Generally, the increased use of fiber optics has corresponded with the cable operators' expansion of system capacity.

The frequencies used in cable TV systems start at about 55 MHz (which is Channel 2), continue through 88 MHz, and resume above 120 MHz. The frequencies between 88 MHz and 108 MHz comprise the FM band, and those between 108 and 120 MHz comprise the aircraft communication and navigation band. These frequencies are not used by cable TV networks, owing to potential interference problems. Frequencies below 55 MHz are not utilized for delivery of cable programming to the home, under current standards. The effective analog capacity of a cable system is therefore determined primarily by the upper bound of the amplifier capability. Five channels can be carried in the 33 MHz between 55 and 88 MHz and additional channels can be carried between 120 MHz and the upper bound of the system. As a result, the channel capacity of any particular cable system can be approximated by the following formula (based on the standard 6-MHz channel size):

$$\text{Cable System Channel Capacity} = 5 + \left(\frac{X - 120}{6}\right)$$

Where X equals total bandwidth of cable system in MHz.

This formula yields the following capacities for analog cable systems.[5]

[4] A single fiber-optic cable can feed multiple coaxial cables connecting to the homes (often referred to as "nodes").

[5] It is interesting to note that the calculated capacities of all of these hypothetical cable systems all fall short of those of satellite delivery systems. In our analysis of DBS systems, we estimated that 32 transponders at a single DBS orbital location support about 320 TV channels.

Cable System Bandwidth (MHz)	6-MHz Channels Supported (Rounded to 5 Channels)
300	35
400	50
550	75
750	110
1000	150

The preceding analysis addresses analog capacity only. As will be shown below, use of digital technology increases the capacity of cable TV systems many-fold. Furthermore, unlike satellite systems, cable systems are essentially local—that is, they each only need to devote as many channels to local coverage as there are broadcast stations in their serving area. The maximum number of local stations that any cable system must carry is about 23 in the largest markets.[6]

2.2. CARRIAGE OF DIGITAL SIGNALS ON CABLE SYSTEMS

Introduction of digital technology into cable TV systems affords a truly staggering increase in potential capacity, as demonstrated by the following calculation:

A quadrature amplitude modulation ("QAM") system, when applied to a 6-MHz TV channel on a cable system, can reliably carry about 39 Mbps. The MPEG-2[7] video encoding standard can deliver an NTSC-quality TV picture using about 4 Mbps of digital bandwidth. If several signals share a channel, statistical multiplexing techniques can be applied to reduce the bit rate even further—to about 3 Mbps. Thus, combining QAM transmission, MPEG-2 encoding, and statistical multiplexing techniques, it is possible to carry 12 digitally encoded NTSC TV programs in a single 6-MHz analog channel. (About 39 Mpbs/3 Mbps = 12 analog programs, with a bit to spare).

In other words, the number of channels supportable by cable systems using analog transmission (depicted by the table in Section 2.1) increases by a factor of about 12

[6] National Association of Broadcasters.

[7] "MPEG" is the acronym for the Motion Pictures Expert Group, a joint committee of the International Organization for Standardization ("ISO") and the International Electro-technical Commission ("IEG"). MPEG-2 is the current digital broadcast standard for cable and network television.

(assuming that digital technology is used for transmission of all channels and all channels broadcast NTSC (or analog) signals).[8]

2.3. DIGITAL TELEVISION – MULTICASTING AND HDTV

In April 1997, the FCC adopted rules designed to migrate the TV industry from the current NTSC (analog) transmission system to one referred to as "digital television" or "DTV," which can support. advanced television services such as HDTV,[9] multiple Standard-Definition TV ("SDTV") programs (multicasts), audio, data and other advanced features and services.

The digital transmission format adopted was the 8-VSB modulation system, that allows 19.4 Mbps of digital information to be carried in a 6-MHz analog channel. If the digitally encoded programming material is then compressed using the MPEG-2 compression arrangement, a high-definition channel, or a number of SDTV channels, can be carried within the 6-MHz channel. Cable systems have a more controlled environment than over-the-air broadcasting. They therefore can use the QAM modulation system mentioned above, which can accommodate 39 Mpbs in each 6-MHz channel—enough to carry two HDTV signals, twelve SDTV signals, or one HDTV and six SDTV signals.

In order to encourage a smooth transition to the new system, the FCC has granted the broadcasters additional spectrum to use for digital transmissions while allowing them to continue use of prior frequency assignments for analog transmission. Upon completion of the conversion, the original frequency assignments are to be released for other uses. Under current "must-carry" rules, cable TV operators are required to carry all local stations requesting carriage and this rule will presumably remain intact after the transition is complete. No decision has yet been made, however, as to the obligations of the cable operators concerning the simultaneous carriage of digital and analog signals during the transition. Dual carriage, however, since it is only useful for the small number of customers with HDTV sets, is likely to be voluntarily supported only in selected circumstances. The FCC opened a proceeding on this matter in 1998 but to date has not adopted a dual carriage requirement.

If cable operators were to carry the digital signals of broadcasters (either voluntarily or otherwise) there are two alternatives. If a cable operator has not converted to digital service, it may simply forward the unaltered 6-Mhz digital signal as transmitted by the broadcasters directly on to its customers. This approach will demand one

---

[8] It should be noted here that, in order to exploit this capacity, customers must be supplied with "set-top boxes" similar to the receivers required for the reception of DBS signals. The rollout of digital cable has been confined, so far, to digital "tiers" containing premium services that command premium prices.

[9] HDTV is a video format promising clearer, more detailed pictures than have been previously possible.

cable channel per broadcast transmission—or a maximum of 23 channels (in the largest markets).

On the other hand, if a cable operator has vigorously pursued digital conversion, it will presumably have ample capacity to carry the digital signals of all local broadcast stations. At two digital signals per 6-MHz analog channel, a maximum of 12 channels will be required for digital cable carriage of all local broadcasts in any market. Reservation of 12 channels for carriage of local digital broadcast signals will impose only a nominal burden on a digital cable system capable of carrying many hundreds of NTSC signals.

2.4. INTERNET ACCESS

Much attention has focused in recent years on the issue of high-speed Internet access. On its face, cable would appear to be an almost perfect medium for this function. Cable is ubiquitously available, it is broadband by nature, and so appears to be able to offer ample capacity. The 39-Mbps rate supported by one 6-MHz cable channel will support substantial Internet usage. Even more capacity can be made available for Internet applications (in 39-Mbps increments) by reassigning additional channels. However, a more likely scenario for increasing capacity is to extend fiber further into the network, so that fewer users will be served on a single (shorter) coaxial section and the same channel can be reused in different coaxial cables. Also, cable has the advantage of being designed as a predominantly a "downstream" medium that carries information from a central source (the cable head-end) "downstream" to the individual users (at the subscriber's receiver). This orientation makes it particularly suitable to the primarily downstream transmission-speed requirements of Internet usage.

Cable provision of Internet does face some complications, however. In principle, cable modem services can support data rates as high as 10 Mbps, although the services offered usually specify a lower maximum rate—on the order of 1-3 Mbps.[10] The rate experienced by any given customer, however, varies according to the total activity on the particular coaxial cable at the moment. This occurs because the medium is shared among users on a packet-by-packet basis, rather than having a fixed bandwidth devoted to each user. In such a system, it is possible for achieved data speeds to slow during heavy traffic conditions, and there have been cable Internet service subscriber complaints as a result. However, as mentioned above, it is well within the capability of the cable operator to remedy such problems by subdividing the coaxial networks or, less likely, by dedicating additional 6-MHz channels to Internet applications.

---

[10] @Home, the largest of the cable modem service providers, specified a maximum rate of about 3 Mbps—*see* www.home.net/speed.html.

Another difficulty facing cable provision of Internet service is carriage of the "upstream" information (information flowing from the user to the Internet). As discussed above, cable systems were originally designed to operate as a "downstream" service only. Hence, the amplifiers used in the systems operate in only a single, downstream direction. In order to carry Internet traffic entirely on the cable network, therefore, the amplifiers must be replaced with units that can operate in two-way (both "downstream" and "upstream") mode—an expensive operation. Amplifiers are frequently replaced and repositioned, however, as system capacity is upgraded. In recent years, therefore, system upgrades have served as an opportunity to replace one-way with two-way amplifiers. The necessary upstream capacity is readily available from the spectrum below 55 MHz, which, under current standards, has been reserved for upstream transmissions.

It is also possible to introduce Internet access service without replacing amplifiers by utilizing some non-cable facilities. Some cable operators have introduced Internet access arrangements that require a telephone connection for the "upstream" channel. Although functional, this is an inferior solution in that it does not provide the "always on" service that is so desirable to users of high-speed Internet access. It also, of course, occupies a telephone line, and requires coordination of the two connections by the Internet access provider.

2.5. VOICE TELEPHONY

Since the passage of the Telecommunications Act of 1996, there has been much speculation that cable TV systems would be used as an alternative to the traditional telephone company ("telco") copper wires to provide genuine competition in local telephone service. The potential for this application was strengthened by AT&T's purchase of several large cable companies and its announced intention to utilize these systems to provide local telephone service. These deployments are known to be expensive, however. As with Internet access, deployment of telephone service over cable systems requires replacement of the amplifiers and, in order to maintain service quality, an increase in the amount of fiber in the plant. In addition, if service reliability at the level that has come to be expected for telephone service is to be provided, a means of maintaining service in the event of the failure of commercial power must be provided. (This has never been done for cable systems, on the grounds that if the power goes out, so does the TV set, so there is no need to continue transmitting.) All of these cable system modifications necessary to provide telephone service cost around $1,000 to $1,200 per connection—a substantial investment if any significant number of telephone lines is to be connected.

Recent developments have tempered speculation of cable's potential as a vehicle for local telephone service. The recent decision by AT&T to spin off its cable operations has substantially dimmed the prospects of aggressive movement of its cable properties into voice services. The high capital requirements detailed above, coupled with the heavy debt load carried by most operators, makes it difficult for most cable operators to deploy voice services very rapidly. However, it had been

anticipated that AT&T—with its large cash flow from other services—would be able to provide the financial support necessary to deploy voice services. The large reductions in long-distance revenues in recent months, though, have made such support problematical, and AT&T's recent decision to separate cable from long-distance operations virtually eliminates the likelihood of such support altogether.

3. RECENT DEPLOYMENTS

In recent years, as cable networks have launched additional programming, many cable operators have sought to upgrade their networks to accommodate the additional channels. The process is expensive and the cable companies are already highly leveraged and therefore have limited ability to borrow. Nevertheless, the larger operators appear to making some progress, investing an estimated $7 billion-plus for rebuilds and upgrades in 1999, up from $4 billion in 1998.[11] In October 1999, 64.2 percent of subscribers were served by systems containing 54 or more channels, up from 61.5 percent in 1998.[12] Generally, the larger systems are being upgraded more aggressively than the smaller ones. Some of the commitments that have been made include:[13]

	Commitment
Time Warner	100% @ 550 MHz and 50% @ 750 MHz by YE 2000
MediaOne	100% @ 550 MHz, 50% 750 MHz by YE 1999
ComCast	85% @ 550 MHz, 63% @ 750 MHz by YE 1999
Cox	63% @ 750 MHz and two way, an additional 11% @ 550 MHz by YE 1999

Paul Kagan Associates, Inc. reports that 82 percent of all cable homes are passed by at least 550-MHz plant, and 65 percent are passed by 750-MHz or higher systems.

[11] FCC, *Sixth Annual Report, In the Matter of Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming*, CS Docket 99-230 (released January 14, 2000) at ¶ 30

[12] *Ibid* at ¶ 22.

[13] *Ibid.* at ¶ 41.

68 percent of all cable homes are passed by activated two-way plant, which can support Internet access capability.[14]

According to the FCC, high-speed Internet services provided over cable systems grew by 59 percent in the first half of the year 2000 to a total of 2.2 million lines.[15] This is a substantial number and a rapid growth rate. Furthermore, the differences between high-density and low-density areas appear to be diminishing, with the growth in availability increasing at a greater rate in low-density regions.[16]

In conjunction with these expansions, the larger cable operators have begun to deploy so-called "digital tiers," which contain a large number of "premium" services. It is estimated that there will be 10.6 million customers for such services by the end of this year, growing to 42 million by 2006 [17]

Time Warner's plans for deployment of digital services appear to be typical of the larger operators. The company is currently deploying a "digital tier" that includes "150 channels of digital and analog TV" (including network programming, local channel rebroadcast and movies on demand), 40 channels of CD-quality music, and high-speed Internet access.[18] Using their stated system capacity of 75 analog channels, we can make the following analysis:

- 'CD-quality" audio probably occupies not more than 1 Mbps of digital capacity. At 39 Mbps per analog channel, only one such channel will likely accommodate all audio transmissions.
- Time Warner may reserve one channel for Internet access, which can be reused in different parts of their coaxial system. (If this turns out to be inadequate, another channel may be allocated.)
- Time Warner would then be able to provide 150 channels of digital and analog programming using the other 73 analog channels. A digitally encoded analog channel can carry 12 programs, while the non-digital analog channels can carry only one. This implies the following relationship, where X represents the number of digitally encoded channels and Y represents the number of analog channels:

$$12X + Y = 150 \text{ and } X + Y = 73$$

---

[14] CTIA, *Cable Industry Overview 2000* (citing Paul Kagan Associates, Inc.) at 1-2.

[15] FCC, *High-Speed Services for Internet Access* (October 2000) at 2.

[16] High-density regions are already virtually fully "covered" (to the extent there is at least some service available).

[17] FCC, *High-Speed Services for Internet Access* (October 2000) at 7.

[18] Time Warner Home Page—www.timewarner.com.

- Solving for X, we find that just 7 channels need to be digitally encoded, leaving the remaining 66 available to provide analog programming to those who do not subscribe to the digital tier.

Some Time Warner publications advertise "over 200 channels of entertainment," which might imply another channel or two devoted to digitally encoded signals. However, even if another dozen channels were devoted to digital signals from the broadcasters, it would still barely impact cable's available capacity. In the most extreme case, where all video programming is assumed to be HDTV, under the above scenario there is capacity for 146 HDTV programs, about as many as they are currently offering with a mixture of analog and digitally encoded standard television signals.

Time Warner also indicates that it will roll out its "digital tier" service to all of its 1.12 million subscribers in the New York market by yearend 2000.[19] This is an ambitious program, and demonstrates how quickly substantial capacity can be added to cable networks.

4. PROBABLE FUTURE SCENARIOS

The future evolution of the cable TV industry will be strongly influenced not only by the technical parameters described above, but by several other important elements, as well. Most importantly:

- Competition and service opportunities;
- Financial constraints;
- Industry organization; and
- Regulatory interventions.

These elements are all interrelated, so they are addressed jointly in the following discussion.

4.1. VIDEO SERVICES

The cable industry has largely dominated the multi-channel video programming distributor ("MVPD") market in recent years, and its profitability has been strongly influenced by regulatory developments. There is currently relatively light regulation of the cable industry in place.

[19] *See* www.twcny.com/dtv/press.html.

Although cable continues to dominate MVPD markets, DBS systems, which have been evolving for a decade, seem to finally be making some progress in penetrating the MVPD market. Ku band DBS system grew almost 30 percent in the last year to almost 16 million customers.[20] Nevertheless, through 1999, cable market penetration had not dropped as DBS penetration has increased.

4.2. HIGH-SPEED INTERNET ACCESS

The above discussion has been focused on distribution of TV programming, which in the past has been the mainstay of the MVPD industry. Looking ahead, however, it seems likely that high-speed Internet access will play an ever-increasing role. Given the rapid growth of the Internet, both in terms of users and content, it would appear the demand for such access is likely to grow explosively.

There exist both financial incentives and disincentives for cable companies to provide high-speed Internet access. The primary incentive is, of course, the potential profitability of capturing a portion of the significant growth in demand for Internet access. The disincentives are more complex. In the first instance, the price a cable company can charge for Internet service is constrained by competition from the telephone companies. Secondly, even if two-way capability is installed in conjunction with cable system upgrades, the expense of additional fiber deployments is required to maintain service quality as demand grows.[21] The capital requirements for these upgrades must compete with those required for the expansion of digital television services, which may be more profitable. Thirdly, operational requirements of Internet access services, in terms of reliability and customer support, are quite different and more onerous and expensive than those for TV distribution.

Some cable operators have sought to bundle access with a particular portal (an arrangement called "closed access"). However, this concept has met with considerable opposition, and is currently being debated in courts and the FCC. It is also a point of controversy in the AOL-Time Warner merger negotiations. Closed access is, of course, part of the strategy of Excite@Home, the largest of the cable modem service providers. It is unclear how much (if at all) enforcement of opening the network facilities to all content providers ("open access") would affect the speed of deployment of Internet access by cable companies, but it will probably slow it somewhat.

---

[20] Skyreport—www.skyreport.com (figures as of April 2001).

[21] As discussed previously, high traffic loads may cause cable Internet access service to slow. One remedy for this problem is to "deload" the overloaded coaxial cable sections. This is usually accomplished by extending the fiber lines closer to the customers, shortening the coaxial lines so that each coaxial cable section serves fewer customers, thus reducing load on the coaxial cables.

As was noted above, there is competition in the high-speed Internet access market, which comes primarily from digital subscriber line ("DSL") service, which utilizes the copper lines owned by the local telephone companies. Although there are currently fewer users of DSL service than of cable modems, subscribership is growing more rapidly.[22]

The telcos, being subject to regulation by the FCC and state commissions, are constrained by rules that generally inhibit their deployment of DSL services. The constraints affect both their financial incentives and operational arrangements. Generally, telcos are required to lease their underlying facilities to competitors at cost,[23] which makes it impossible for them to capture whatever competitive advantages their technology produces. Operationally, telcos are obliged to provide Internet access service using separated subsidiaries, which increases both the cost and complexity of service provision and maintenance.[24] There are, of course, many smaller companies that are providing service using the telco's facilities, but they face many problems of their own—reliance on the facilities of a competitor is not the easiest road to success.[25]

The satellite operators probably pose a lesser competitive threat to cable operators in the Internet access market than do the telephone companies. Current satellite Internet access services rely on a telephone channel for upstream service.[26] This reliance is probably a significant drawback, since requiring use of a phone line does not allow the service to be "always on,"[27] a significant advantage of other high-speed access arrangements. Recently, both DBS operators have announced availability of two-way Internet service via satellite, using Ku- and, ultimately, Ka-band satellites (excluding those designated for traditional DBS services). The DBS Internet access services, while functionally equivalent to terrestrial services, are substantially more

---

[22] The FCC reports that there were almost one million DSL lines in June of 1999, an increase of 157 percent from yearend 1999. [FCC, *High-Speed Services for Internet Access* (October 2000), at 2.]

[23] Or below cost, depending on one's view of the incremental cost formulas currently being applied.

[24] The telcos are in a difficult position with respect to these services. On the one hand, their costs are increased and their operations made more complex by the need for separate subsidiaries. On the other, their prices are constrained by "competitors" who utilize the telcos' facilities, leased at or below cost. These policies may keep prices down, but do not promote rapid deployment.

[25] Covad and Northpoint, two of the largest DSL providers, have been experiencing difficulties. Covad recently announced a downsizing, and Verizon cancelled a planned purchase of control of Northpoint because of Northpoint's deteriorating finances.

[26] Some cable modem services use this method also, but this will likely be a temporary expedient until they upgrade their systems.

[27] Unless the telephone line is fully dedicated to the upstream service.

expensive than either cable or DSL, so are targeted primarily at customers who do not have access to terrestrial services.[28]

4.3. TERMINATING ACCESS

It should be noted that, regardless of how the market develops competitively, both cable and DBS operators may have what could be called a "terminating access monopoly" (or, in the terminology of economics, a "monopsony"). That is, a particular customer will typically have one kind of service or another (cable or DBS), but not both. From the standpoint of the program supplier, then, it is critical that it have access to *both* (cable and DBS) providers. If a programmer lacks access to a cable system, it cannot reach the cable customers, and similarly for DBS. Thus, even if cable's market share drops from its recent 82 percent of the MPVD market[29] to a much lower number (even, say, 50 percent), it remains critical that broadcasters who want to reach their entire market have access to those cable systems, else a significant fraction of the market will be effectively closed to them.

Whether a particular carrier—be it cable or DBS—makes capacity available to a particular program supplier depends on that carrier's available capacity and ability to expand that capacity, its financial incentives, and the regulations it faces. The above discussions indicate that it is technically feasible for cable operators to provide sufficient capacity (although at some cost) to carry all stations in the local market, but that the financial incentives may not favor carriage of all local stations. The impact of regulations is less clear, as the applicable regulations are currently in a state of flux.

4.4. CURRENT AND FUTURE PLANS OF CABLE OPERATORS

The cable operators' expansion of system capacity will presumably continue. They have been actively rolling out "digital tiers," which are presumably profitable and allow them to compete more effectively with the DBS operators. They have also been rolling out cable modem service. Cable networks appear poised for an acceleration of these modem service deployments, but the speed of future deployment may well be influenced by regulatory developments. Finally, cable operators have been increasing their carriage of HDTV programs in certain markets.

Much of what the cable operators do may be determined largely by their financial constraints. The cable industry, as a whole, has a debt-to-equity ration in excess of 3, with several of the larger operators having negative equity. The acquisition of TCI and MediaOne by AT&T gave promise that, at least for these companies, there could be an infusion of badly needed capital. However, AT&T's decision to reverse course

---

[28] Richard Williamson, "Sky-High Connection," on *Interactive Week* from ZDWire (November 14, 2000).

[29] FCC, *Sixth Annual Report*, Docket 99-418, Appendix C, Table C-1.

and divest their cable holdings weakened that promise significantly. Indeed, the large premiums paid for the systems by AT&T may have worsened the financial situation of the carriers they acquired. The AOL-Time Warner merger, even if it goes through, is not likely, by itself, to provide much capital infusion, although Time Warner is already a well-diversified company with revenue from many quarters.

Given all these considerations, it appears likely that cable operators will continue to deploy "digital tiers" as their finances allow. They will carry broadband digital signals to the extent they are required or to the extent they perceive a substantial market for such services. There are no technical limitations to the number of channels that can be devoted to digital, but there are market limitations. The cable operators must retain enough analog channels to serve their analog customer base. If the number of channels required for analog services is approximately 50, a 75-channel system leaves only 25 channels for digital tiers: 25 channels can support over 250 narrowband digital programs, even if one or two channels are reserved for Internet access. Enough capacity remains for dual carriage, since we estimate that at most 12 channels are needed for this purpose. If large numbers of the national programs delivered by the cable networks use HDTV formats, however, this could create some contention among the various uses. The increasing number of cable systems with 110 channels and more, of course, eases these problems substantially.

Cable operators have begun to offer some HDTV programs in their service areas, with offerings ranging from two to as many as nine programs (by Time Warner, in Houston). Time Warner, in fact, has offered to inexpensively lease high-definition receivers for those with "HDTV ready" sets, a move that may serve to accelerate the adoption of HDTV service by lowering the price.[30] Nevertheless, HDTV remains very expensive for consumers.

Set-top boxes ("STBs") are another issue of some importance when considering cable system deployments, strategies and capacity. STBs are a complex subject, regardless of the deployment strategies of the cable operators, and a detailed analysis of potential developments would require a separate study. However, as STBs may impact the strategies of the cable operators, we provide a cursory review some of the most salient characteristics of STBs, below.

STBs originally were simple devices to allow television broadcast signals that had been remodulated for cable carriage to be viewed on ordinary television sets. These simple devices were ultimately integrated into the television sets, which could then marketed as "cable ready." STBs were reintroduced as scrambling devises to prevent the unauthorized reception of premium channels.

---

[30] See www.timewarner.com.

The advent of digital technology and digital television has drastically changed the functionality and application of STBs. Modern STBs are capable of providing numerous functions, including security, navigation, storage and ancillary functions such as closed captioning. Furthermore, though STBs are now normally provided by cable operators, the FCC has mandated that they be provided by the customer by 2005, and there is currently a proceeding underway to review that policy. [31]

Plainly, the cable TV operators must deploy STBs in conjunction with their digital tiers to enable their digital signals to be viewed on analog television sets. Since these boxes tend to be procured in large numbers, they are quite price-sensitive. A few dollars per unit of additional cost can quickly translate into millions for the cable operator. Hence, there is strong market pressure to keep STBs as simple as possible, consistent with the needs of the operator.

CableLabs, a research facility established by the cable companies, is currently sponsoring a project called "OpenCable,"[32] which will specify interfaces for cable boxes and other devices with varying functionality. It is an open-forum project, inviting participation from all industry members. The intent is to continue to develop interfaces that will allow the latest technological advances to be incorporated in STBs and other appliances, so that the necessary functionality can be provided, while keeping costs commensurate with specific needs.

The specific functionality that will be adopted by particular operators, however, is a function or their perception of the needs of their market. Hence, although it might appear to be desirable to deploy STBs that will accept both narrow-band and broad-band digital signals and that may be used with both digital and analog television sets, this may not happen fully in the near term. Instead, operators are likely to adopt a partial solution (within the constraints of the OpenCable interface set) that will minimize their costs while meeting their own perceived market needs. In particular, it is unlikely that they will widely deploy HDTV-compatible boxes (or carry HDTV local programming) until there is a reasonable population of HDTV receivers in their service area.

---

[31] FCC, *Further Notice of Proposed Rulemaking*, Docket No.97-80 (adopted September 14, 2000).

[32] OpenCable Innovative Platforms—www.cablelabs.com.